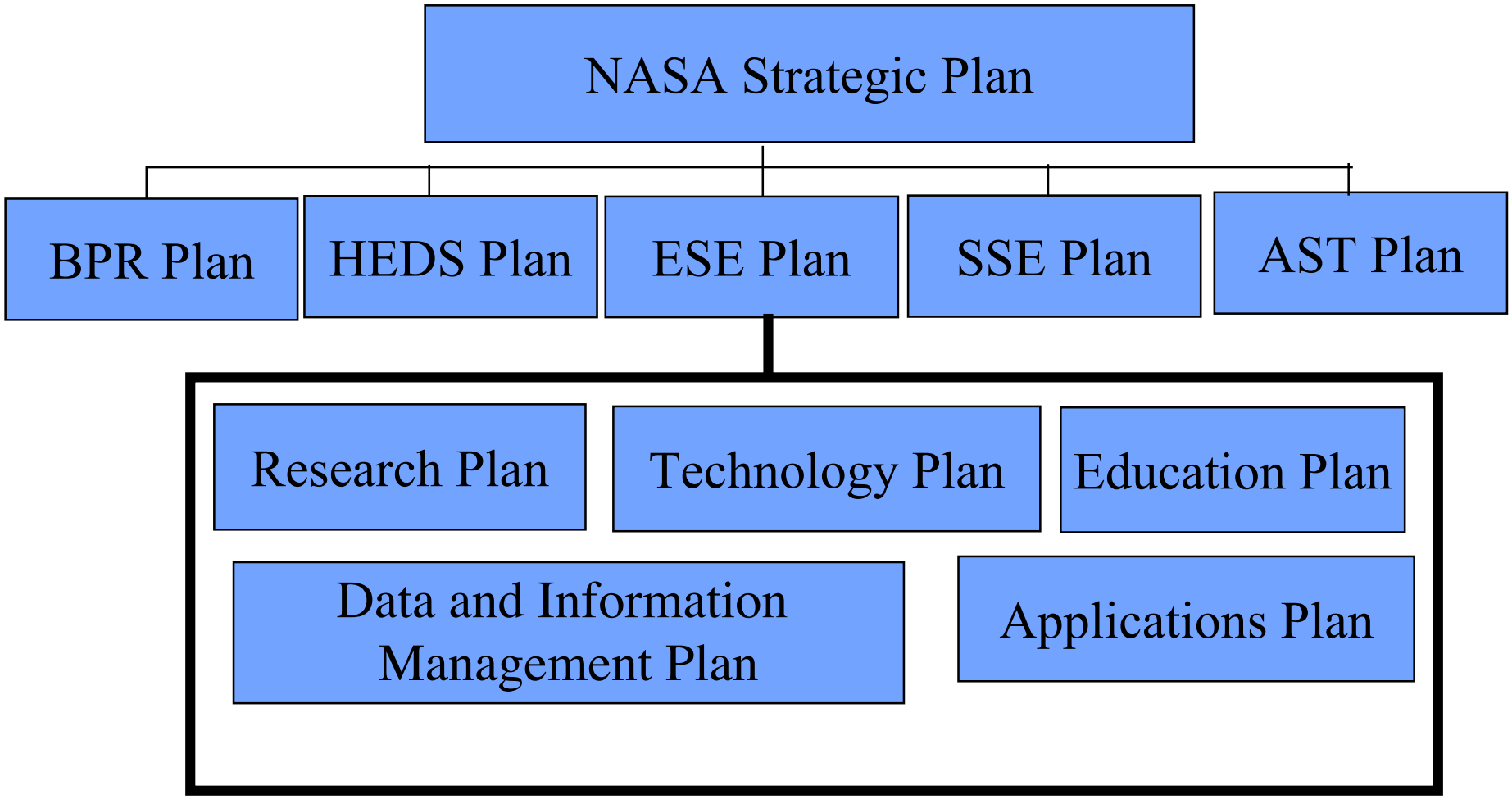
Plans Hierarchy

JC Duh



Status

- Intend to respond to the NASA Strategic Plan, and following the NASA Vision and Mission statement.

- Research Strategy will be updated to reflect the 6 themes

- Applications Strategy summary addresses two other goals in the NASA Strategic Plan (improve air transportation and create a more secure world) as well as our applications program

- Technology Strategy summary will be reshaped to reflect the three components of geospatial, communications, and computing technologies, and be shortened

- Plan to have ESSAAC review the draft in May, 2003.

ESE Strategy Outline

Letter from Ghassem

Improving Life Here: Earth Science in NASA's Vision

The Value of Earth System Science and NASA's View of Earth as a Planet

Science For Society – The Framework for Strategic Planning

Earth Science in NASA's Mission

1. Earth System Science & Applications: Leading NASA's Mission to Understand and Protect Our Home Planet

1.1 Understand How the Earth is Changing, Better Predict Change, and Understand the Consequences for Life on Earth

- 1.1.1 Predicting Climate Variability and Change
- 1.1.2 Impacts of Atmospheric Composition on Ozone, Climate & Air Quality
- 1.1.3 Impacts of Carbon Cycle & Ecosystems Change on Climate and Life
- 1.1.4 Water Cycle Dynamics on Climate and Fresh Water Availability
- 1.1.5 Improving Weather Forecast Duration & Reliability
- 1.1.6 Predicting & Mitigating Natural Hazards from Earth Surface Change

1.2 Expand and Accelerate the Realization of Economic and Societal Benefits from Earth Science, Information, and Technology

- 1.2.1 Earth Science Applications for National Decision Support Systems
- 1.2.2 Contributing to the Nation's Air Transportation System
- 1.2.3 Contributing to Our Nation's Security

ESE Strategy Outline (Continued)

2. Earth as Paradigm: Supporting NASA's Mission to Explore the Universe

3. Inspiring the Next Generation of Earth Explorers: Our Essential Role in Education

- 3.1 Sparking the Revolution in Earth Science Education
- 3.2 Motivating Students to Pursue Careers in STEM
- 3.3 Engaging the Public in Earth Science Exploration and Discovery
- 3.4 Capacity Building for National Applications

Enabling Capabilities – Pursing Earth System Science As Only NASA Can

- Research Plan
- Applications Plan
- Data and Information Management Plan
- Technology Plan
- Education Plan
- Organizational Strategy
- In the NASA Team
- External Partnerships

Our Vision of the Future: Earth System Prediction in 2030

Appendices

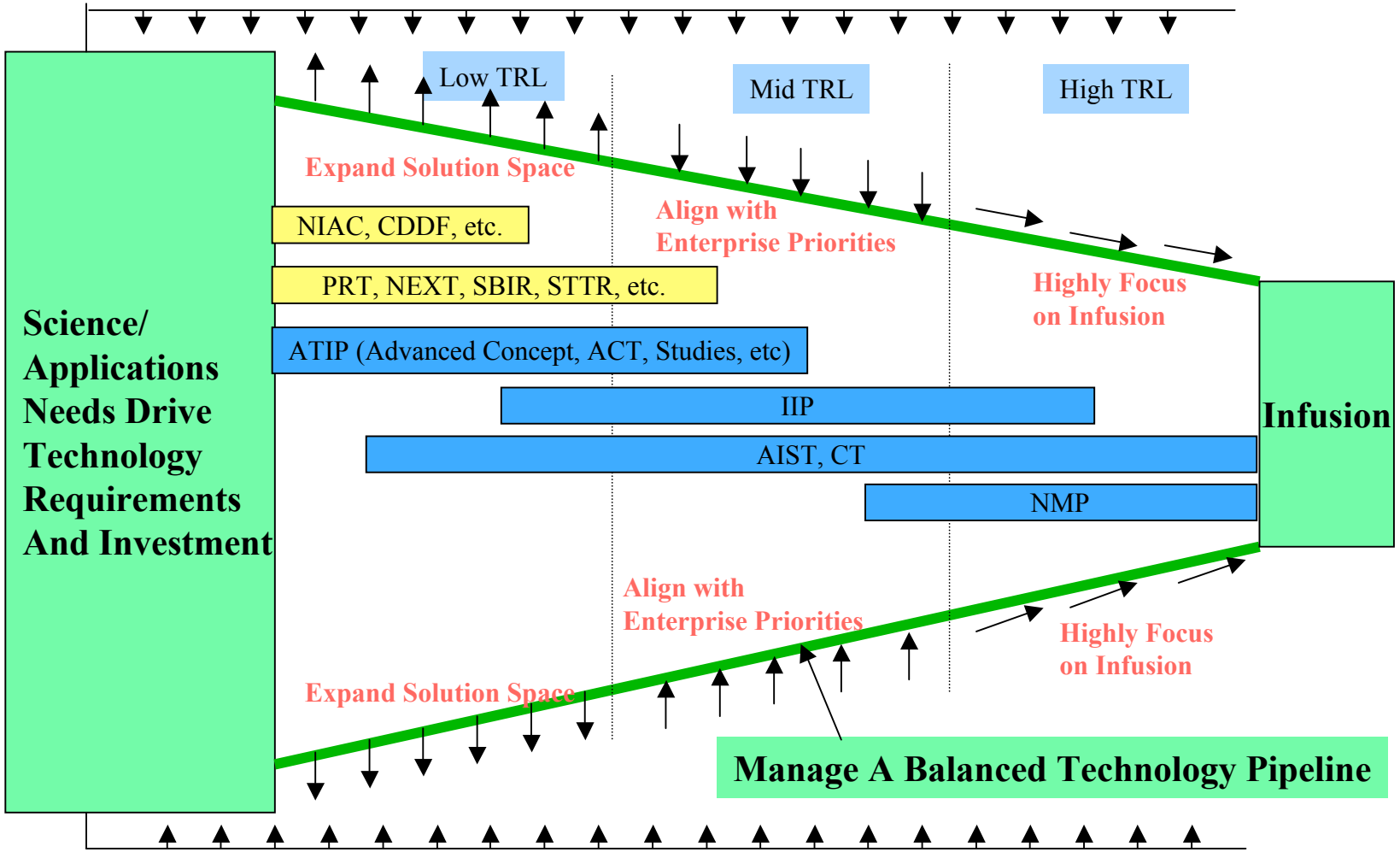
Technology Plan Summary

- Technology Program Goal

  plan, develop, and infuse advanced technologies to enable science and applications priorities

- Proposed Technology Thrusts: (will change to Geospatial, Communications, and Computing)
  - **Observing Technologies**: Develop advanced technologies to expand the capability while reducing the cost of Earth observation (enable the observation of anywhere and everywhere on Earth, any time and all the time)
  - **Information Technologies**: Develop advanced technologies to expand the capability of processing, communicating, computing, and applying Earth science data and information products

Technology Plan Summary



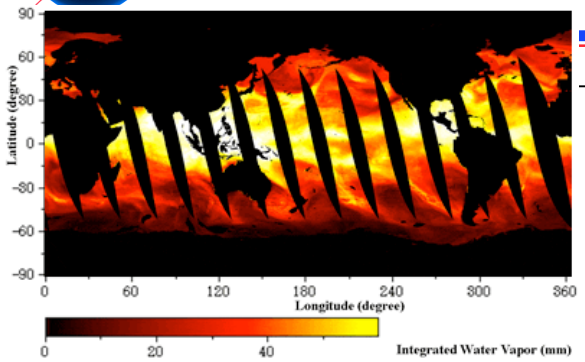
Technology Plan Summary

Observational Technology Area	*Primary challenges*
Passive imaging systems	Large format detectors
Passive & active microwave	Large deployable antennas, both full aperture and synthetic aperture; and associated receiving and distribution devices
Imaging spectrometry	Fast, compact optics and grating systems
Active optical imaging systems	Lightweight, high power, cooled, reliable laser systems for lidar applications
Formation flying to achieve ultra-large space baselines	Deployment of large antennas (100 m class); autonomous operation of constellation
Quantum device sensors	Provide atom manipulation and laser cooling capabilities for advanced quantum interference sensing capabilities

Technology Plan Summary

Information technology area	*Primary challenges*
On-board Data Processing	Apply and adapt commercial technology to achieve fault-tolerant, high throughput on-board processors
Space-based Communications	Enable sensorweb concept through development of protocols for dynamic space links
High-end Computing	Enable high fidelity (both temporal and spatial) models of the Earth processes that assimilate the full range of relevant satellite data
Information synthesis (data mining, fusion, manipulation, visualization)	Derive information from extremely large, multi-mission data sets; provide rapid, portable access and dissemination of data
Mission Automation	Develop real-time event detection and image recognition; self-tending spacecraft &instruments
Data access and dissemination	Provide access to extremely large data sets, extraction of small sized data subsets and geolocation references to multi-mission data sets.

How Will Water Cycle Dynamics Change in the Future?



10 year Outcomes

- Forecasts of fresh water availability and distribution useful to agriculture and water resource managers
- Seasonal forecasts of precipitation
- Snow pack and melt time prediction for planning energy generation and commerce
- Long range water cycle prediction for infrastructure planning
- Essential input to weather and climate models

Outputs

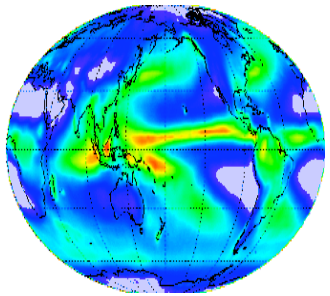
Improved precipitation forecasts that support water supply-related decisions with 7-10 day lead time and seasonal water supply forecasting

Quantify water cycle state and variability, including precipitation, evaporation, runoff, and storage

Assessment of natural variability in atmospheric, surface, and subsurface moisture stores

Improved representation of heat and convection through precipitation in weather and climate models

Systematic measurement of atmospheric water vapor, snow cover



Inputs

(see table on next page)

2002 ⟶ 2014

Today's products

- Water budget balanced over global scales and long time frames to within 20%; large uncertainties on regional to local scales and annual / seasonal time frames
- Precipitation measured over the tropics, but cannot measure or predict globally
- Soil moisture largely unknown globally

Research Plan Input

	Current / Planned	Future	Technology
Atmosphere	Water vapor from Aqua, NPP Precipitation from TRMM, GPM Cloud structure from Cloudsat	Data continuity via research & operational satellites Global monitoring of water and energy from geostationary orbit	Advanced microwave radiometry, and sounder, space-based DIAL
Oceans	Sea Surface Temp from Aqua, NPP	Data continuity via research & operational satellites Mixed layer depth Coastal zone / estuarine / fresh water mixing	Advanced hyperspectral radiometer, advanced imaging spectrometry
Land	Snow cover from Terra, Aqua, NPP Hydrologic yield, evapotranspiration via Terra, Aqua, Landsat	Data continuity via research & operational satellites Soil moisture to rooting depth via satellite Global river discharge	SAR, polarimeter
Solid Earth	Gravity perturbations due to water distribution via GRACE	Higher resolution gravity measurement for change detection	Laser interferometer, quantum gravity gradiometer
Data Understanding	Principal Investigator-led data processing Distributed active archives	Science parameter (multi-source, many access) distributed data processing Virtual data archive	Standards & interface protocols Data mining & data fusion
Predictive Capabilities	Beginning stages of ecosystem modeling, assimilation of key new data types	10^4 x today for regional resolution modeling & assimilation of new data	High sustained computing throughput, advanced high volume data management, visualization and data mining